41 87, NEN 5350, MIL C 27 227, ECCA test methods, at a layer thickness of 5 μm.

The bond strength was measured according to the cross-hatch test (ISO 2409). After folding, the layer exhibited regular cracks parallel to the knee of folding, but no signs of delamination.

The strip, after coating with the functional coating using the soil-gel process is provided with a PVD reflectivity enhancing coating (Antiflex B® of Balzers) and exhibits the following reflectivity values acc. to DIN 5036 Part 3:

Total reflectivity>95% and scattered reflectivity<1%.

The PVD layer is securely attached to the substrate and does not free itself from the functional coating even after pronounced deformation by e.g. folding.

We claim:

1. A reflector, having a surface which is resistant to mechanical and chemical attack and has high total reflectivity, wherein the metal body (10) of the reflector has a surface layer in the form of a layer system comprising:

(A) a pretreatment layer (11), which is (i) an oxide layer produced by anodizing with forming in a redissolving or non-redissolving electrolyte, or (ii) a yellow chromate layer, a green chromate layer, a phosphate layer or a chrome-free layer formed in an electrolyte containing at least one of the elements Ti, Zr, F, Mo and Mn, onto which is deposited:

(B) a functional layer (12) of a silane, having at least one organo-functional group of a metal compound, and said functional layer comprising one or more layers of materials which have been obtained by hydrolytic condensation, optionally in the presence of a condensation catalyst and/or normal additives, of the following starting components:

(a) at least one cross-linkable silane, having at least one organo-functional group, of formula (II):

$$R'''_m SiX_{(4-m)} \qquad (II)$$

in which groups X, which are the same or different, stand for hydrogen, halogen, alkoxy, acyloxy, alkylcarbonyl or —NR"$_2$, wherein each R" is hydrogen or alkyl, and the radicals R'", which are the same or different, represent alkyl, alkenyl, alkinyl, aryl, arylalkyl, alkylaryl, arylalkenyl, alkenylaryl, arylalkinyl or alkinylaryl, whereby these radicals can be interrupted by O- or —S atoms or the group —NR" and optionally bear one or more substituents from the group consisting of halogens and optionally substituted amino, amide, aldehyde, keto, alkylcarbonyl, carboxy, mercapto, cyano, hydroxy, alkoxy, alkoxycarbonyl, sulfonic acid, phosphoric acid, acryloxy, methacryloxy, epoxy and vinyl groups, and m has the value 1, 2 or 3, and/or one oligomer derived therefrom, where the radical R'" and/or the substituted must be a cross-linkable radical or substituent, in an amount of 10 to 95 mol percent, referred to the total mol number of monomers of said starting components;

(b) at least one metal compound having the general formula III:

$$MeR_y \qquad (III)$$

in which Me is Al, Zr or Ti metal, where y in the case of aluminum is 3 and in the case of Ti and Zr is 4, and the radicals R, which are the same or different, stand for halogen, alkyl, alkoxy, acyloxy or hydroxy, where the last mentioned groups are replaced wholly or partially by chelate ligands and/or one oligomer derived therefrom and/or optionally a complexed aluminum salt of an inorganic or organic acid in an amount of 5 to 75 mol percent, referred to the total mol number of monomers of said starting components,

(c) optionally at least one non cross-linkable silane, having at least one organo-functional group, of formula I:

$$R'_m SiX_{(4-m)} \qquad (I)$$

in which groups X, which are the same or different, stand for hydrogen, halogen, hydroxy, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or —NR"$_2$, wherein each R" is hydrogen or alkyl, and the radicals R', which are the same or different, represent alkyl, aryl, arylalkyl or alkylaryl, whereby these radicals can be interrupted by O- or S-atoms or the group —NR" and can bear one or more substituents from the group consisting of halogens and optionally substituted amide, aldehyde, keto, alkylcarbonyl, carboxy, cyano, alkoxy and alkoxycarbonyl groups, and m has the value 1, 2 or 3, and or one oligomer derived therefrom, in an amount of 0 to 60 mol percent, referred to the total mol number of the monomers of said starting components, and

(d) optionally one or more non-volatile oxides of an element of the main groups Ia to Va or sub-groups IIb, IIIb and Vb to VIIIb of the periodic system which is soluble in the reaction medium, with the exception of Al, and/or one or more compounds of one of these elements forming a non-volatile oxide under the reaction conditions, which is soluble in the reaction medium, in an amount of 0 to 70 mol percent, referred to the total mol number of monomers of said starting components,

carried out such that:

(1) an organic prepolymer is added to this hydrolytic condensate, whereby reacting cross-linkable groups of the radical R'" and/or the cross-linkable substitutes on the radical R'" are linkable to those of the prepolymer or are identical to those of the prepolymer, and the prepolymer is added in an amount of 2 to 70 mol percent, referred to the total mol number of monomers of said starting components, and

(2) the coating solution thus obtained is deposited on a substrate and subsequently cured,

onto which is deposited:

(C) a metal containing reflective layer (13),

where layer (A) is deposited on the reflector body and increases the strength of bonding to the above lying layers (B) and (C), and layer (B) effects a flattening and increase in the mechanical strength of the above lying layer (C).

2. The reflector according to claim 1, wherein the pretreatment layer (A) has a thickness in the range of 20 to 1500 nanometers.

3. The reflector according to claim 1, wherein the pretreatment layer (A) has a thickness in the range of 50 to 1500 nanometers.

4. The reflector according to claim 1, wherein the pretreatment layer (A) has a thickness in the range of 100 to 1500 nanometers.

5. The reflector according to claim 1, wherein the pretreatment layer (A) has a thickness in the range of 150 to 1500 nanometers.

6. The reflector according to claim 1, wherein the pretreatment layer (A) has a thickness in the range of 20 to 200 nanometers.

7. The reflector according to claim 1, wherein the functional layer (B) is 0.5 to 20 μm thick.

8. The reflector according to claim 1, wherein the functional layer (B) is 1 to 20 μm thick.

9. The reflector according to claim 1, wherein the functional layer (B) is 2 to 10 μm thick.

10. The reflector according to claim 1, wherein the functional layer (B) is 2 to 5 μm thick.

11. The reflector according to claim 1, wherein the functional layer (B) is composed of a single layer or a multiple layer and the multiple layers are all of the same material or of different materials, in each case being selected from the materials in the functional layer (B).

12. The reflector according to claim 1, wherein the reflective layer (C) is a multilayer system comprising a reflecting layer and deposited on that transparent protective layers with different refractive indices.

13. The reflector according to claim 1, wherein the reflective layer (C) is a multilayer system comprising a reflecting layer and deposited thereon transparent protective layers with different refractive indices, the reflective layer being 10 to 200 nm thick and each of the transparent protective layers being 40 to 200 nm thick.

14. The reflector according to claim 1, wherein the reflective layer (C) is or contains a metal from the series Al, Ag, Cu, Au, Cr, Ni or an alloy containing mainly at least one of these metals.

15. The reflector according to claim 1, wherein a bonding layer is provided between the functional layer (B) and the reflective layer (C).

* * * * *